# Requirements for a software API to cover automotive video applications

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Corporate Overview

- **Leading provider of:**
  - High-performance microcontrollers, digital signal controllers and microprocessors
  - Mixed-signal, analog, interface and security solutions
  - Clock and timing solutions
  - Wireless and wired connectivity solutions
  - Non-volatile EEPROM and Flash memory solutions
  - Flash IP solutions

- **~ $3.5 billion revenue run rate**

- **~13,000 employees**
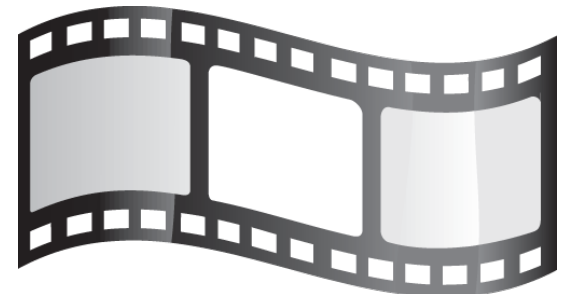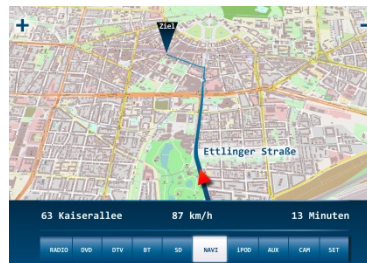
- **Headquartered near Phoenix in Chandler, AZ**

Video in Automotive

![MICROCHIP]
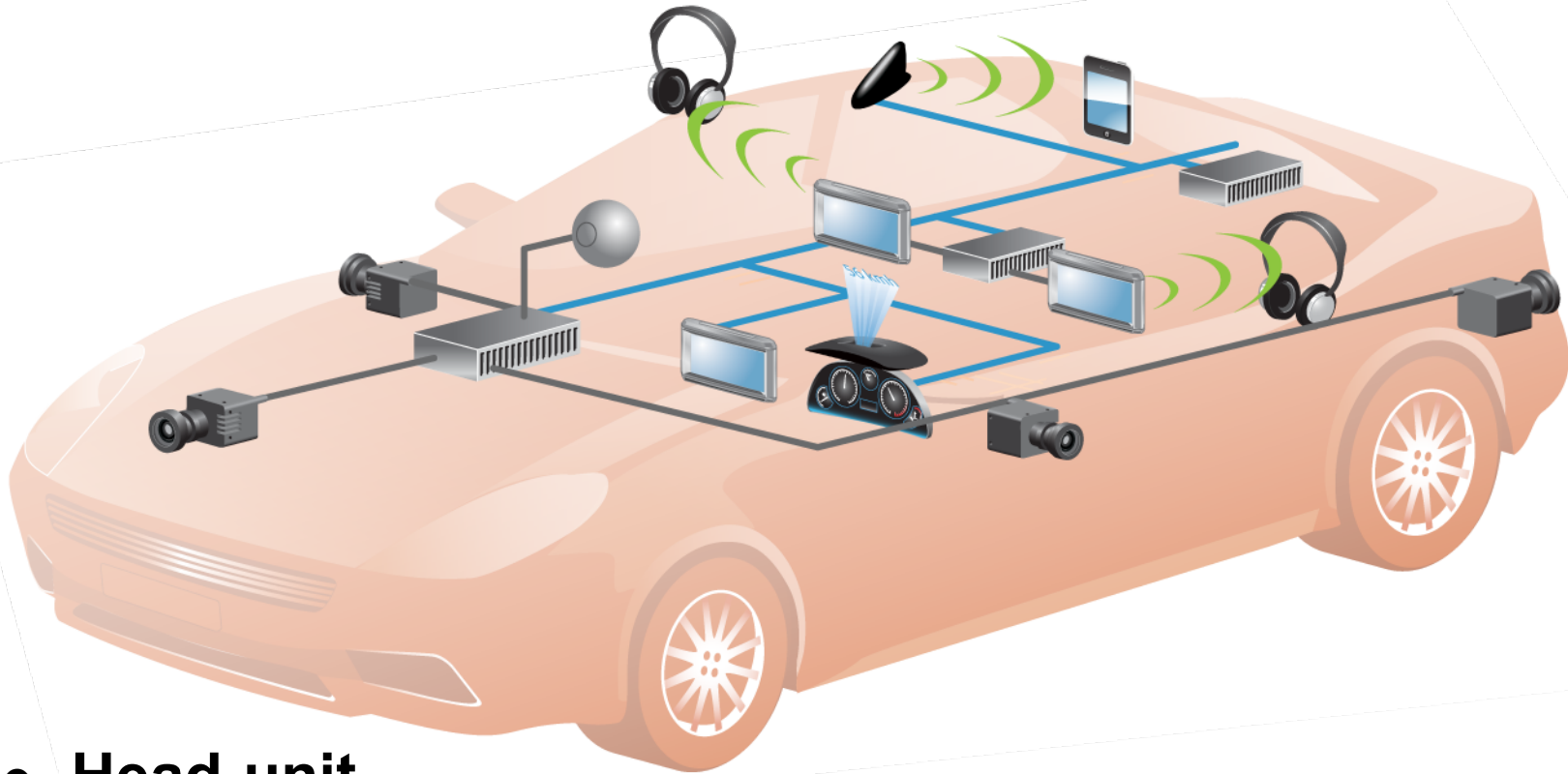
- **Head-unit**
- **Cluster / HUD**
- **ADAS ECU**
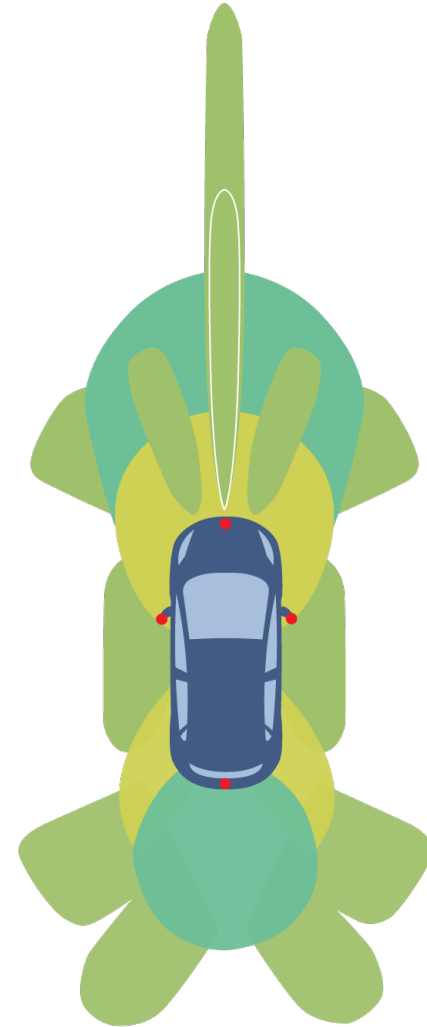
- **Rear-seat entertainment**

Infotainment Apps

- **Watching TV**
- **Navigation on all displays**
- **Playing movies**
- **Integration of mobile devices**

Camera Apps

- **Rear-view camera**
- **Top-view**
- **Passenger observation**
- **Position detection**
- **Digital mirror**
- **Park assistant**
- **Break assistant**
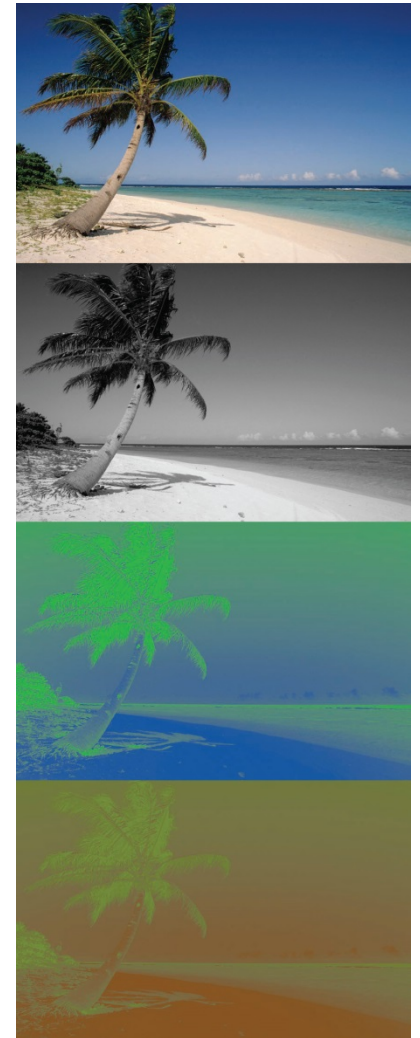- **Drive assistant**
- **Autonomous driving**

Formats

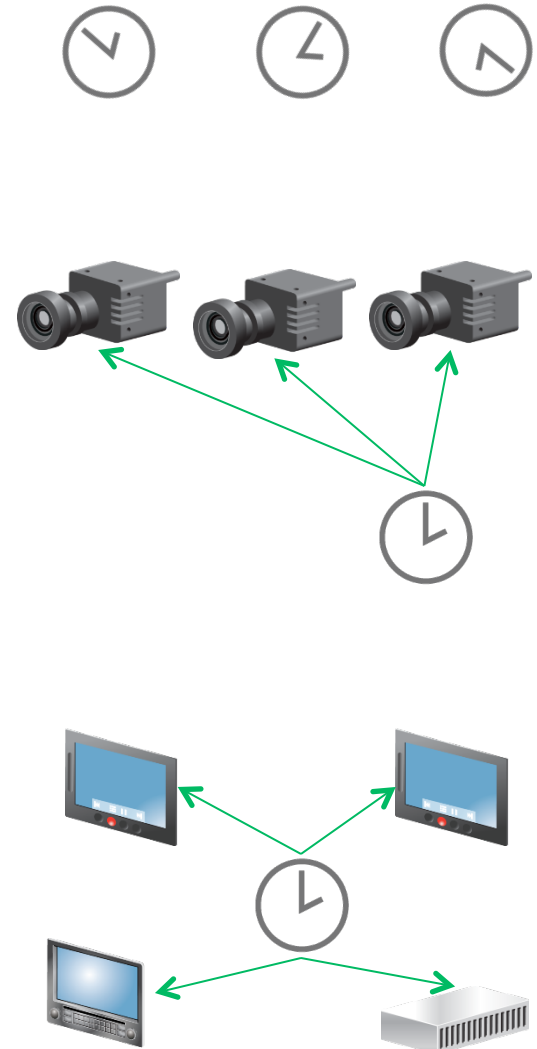- **Uncompressed**
  - Bayer RGB
  - YUV
  - RGB
  - …
- **Compressed**
 - MJPEG
  - H.264
  - H.265
  - …

Clock Domains

- **Multiple clocks in the system**
  - Tuner, LTE modem, mobile device, …

- **Synchronization**
  - Sources
    - Multiple cameras stitched together to one top-view image
    - Stereo-camera to measure obstacle distance
    - …
  - Sinks
    - Multiple displays showing the same stream
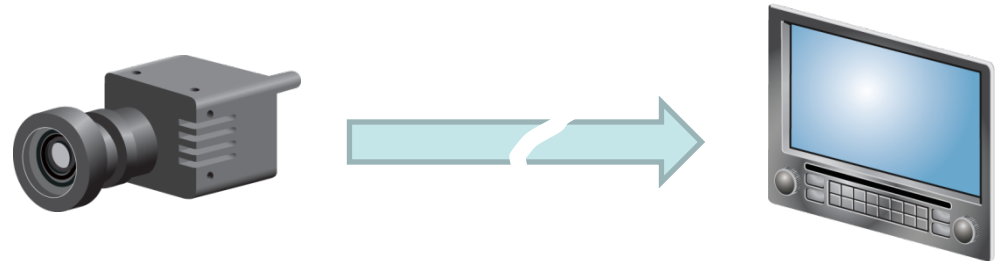   - Video synchronized to cabin sound
    - …

Safety Aspects

- **Pack all data for transmission**
  - Clocking
  - Presentation time
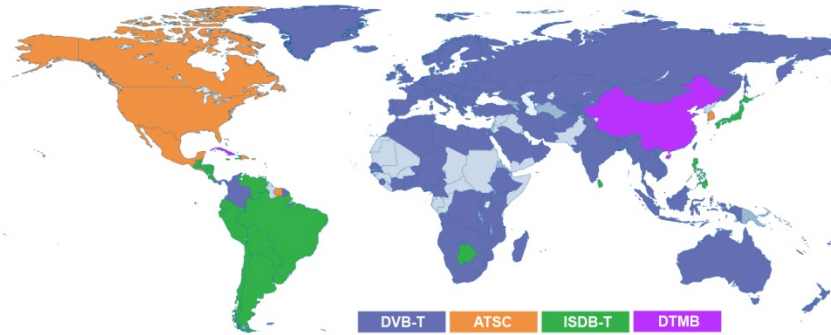 - CRCs
  - …
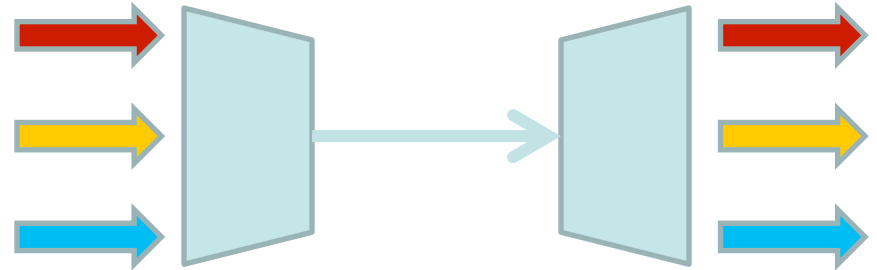
- **Do not show old pictures in safety critical applications**
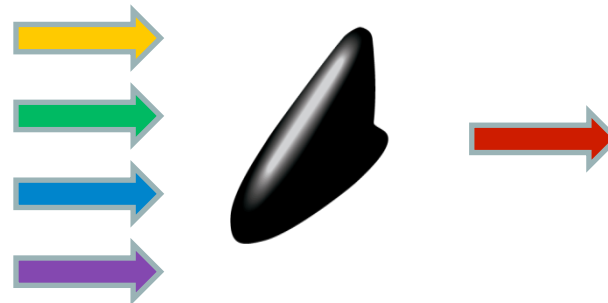
Legal/Commercial Aspects

- **Support country-specific solutions**
  - DVB-T
  - ATSC
  - ISDB
  - DTMB
  - …

- **Use as few codecs as possible in each device to keep license cost low**

- **Support content protection**

Content Protection

Content-owner required to protect their streams when transmitted inside car

Medium	Consortium	Scheme
DVD	DTLA(5C)	DTCP
Blu-Ray	DTLA(5C) / DCP	DTCP / HDCP
DVB-X, …	CI+	DTCP / HDCP
Miracast	DCP	HDCP

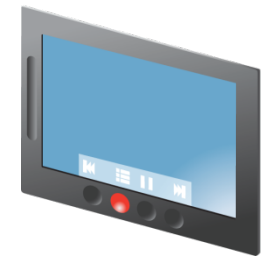**Consider also new streaming services**

Organizational Aspects

- **Different groups provide different content parts**

- **Only one department is responsible for final front end**
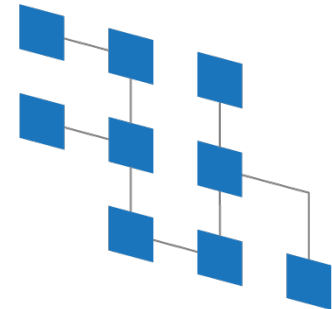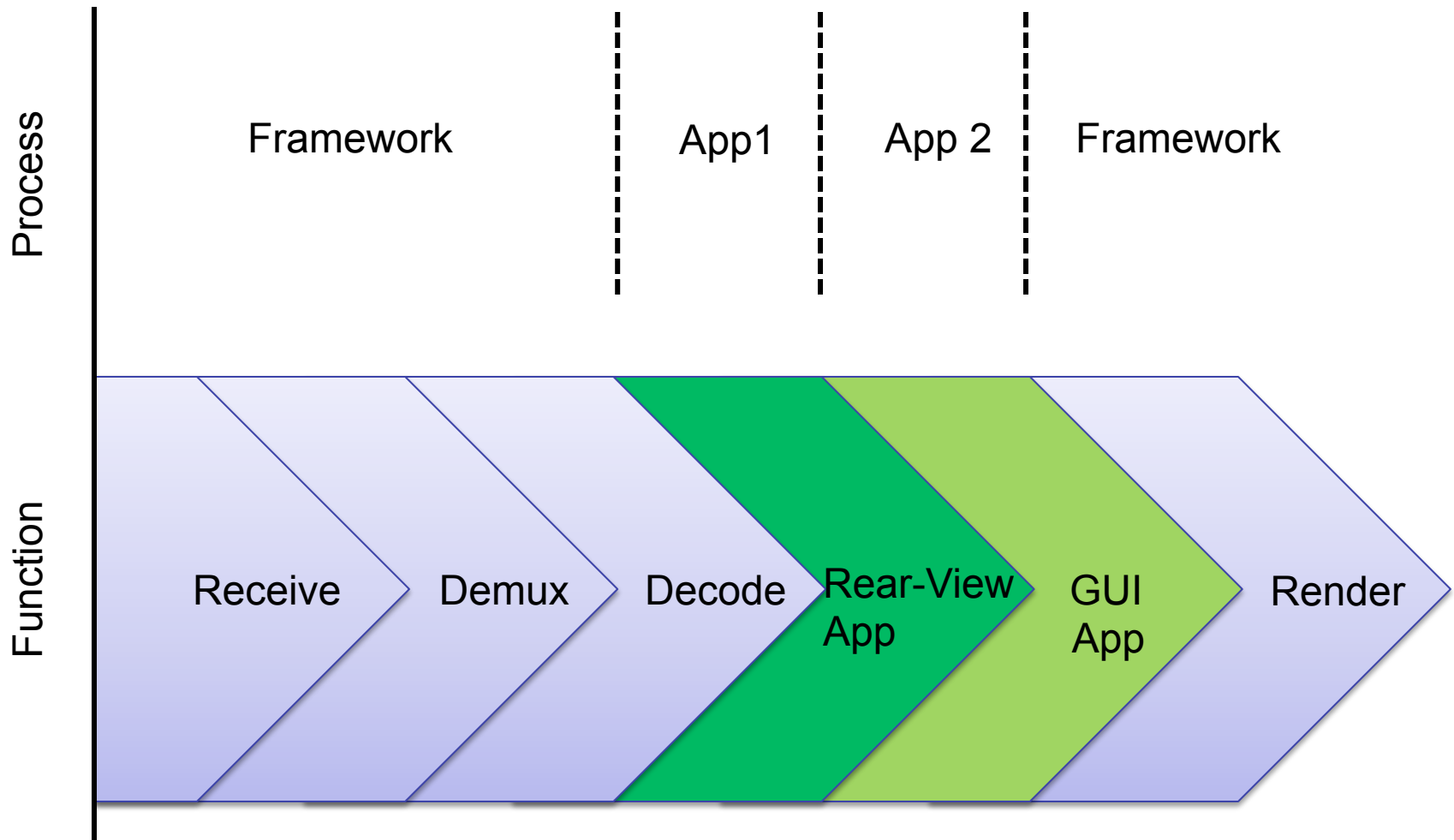
Tuner Department
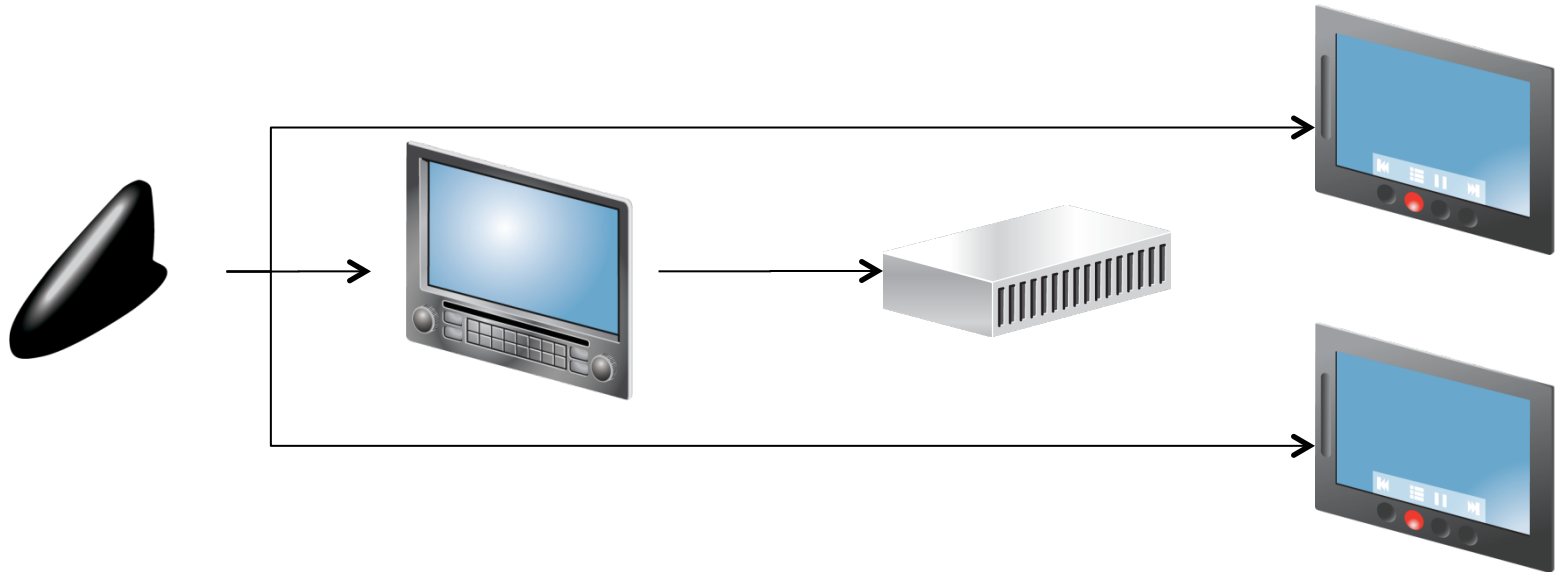
Navi Department

GUI Department

Programming Aspects

- **Support different languages like C, C++, Java, HTML5, Qt, …**

- **Small footprint to support small embedded systems**

- **No, or only little, dependencies**

- **During runtime independent from state machines**

Example: Display Rear-View Camera

Example: Watching TV

Antenna
- Receive
- Demux
- Decode
- Overlay
- Encode
- Multiplex
- Send

Head-unit
- Receive
- Demux
- Decode
- Embed in GUI
- Render
- Send PCM

Amplifier
- Receive
- Mix
- Render

Rear-seat
- Receive
- Demux
- Decode
- Embed in GUI
- Render

Functionalities

- **Source**
  - File
  - cdev
  - Capture
  - Socket
  - Pipe
  - Shared mem
  - …

- De-/multiplex
- Decode
- Encode
- En-/decrypt
- Fork
- Re-timer
- Overlay
- …

- Render
- File
- cdev
- Socket
- Pipe
- Shared mem
- …

- **Convert**

- **Sink**

Data Container

- **TS Packet**

- **Timestamps**
  - PTS
  - PCR

- **PES Packet**
  - H.264
  - MJPEG
  - ...
  - MP3
  - AC3
  - DTS

- **Raw**
  - RGB
  - YUV
  - …
  - PCM
  - PDM
  - …

Already Available Functionalities

- **GStreamer**

- **OpenMax**

- **libva**

- **Ffmpeg™**

- **Unfortunately none covers all requirements listed before**

Framework Prototype Already Available

- **Microchip developed major parts of a framework for networked video applications**
  - Rear-view camera
  - Head-unit delivering navigation picture
  - Cluster display device
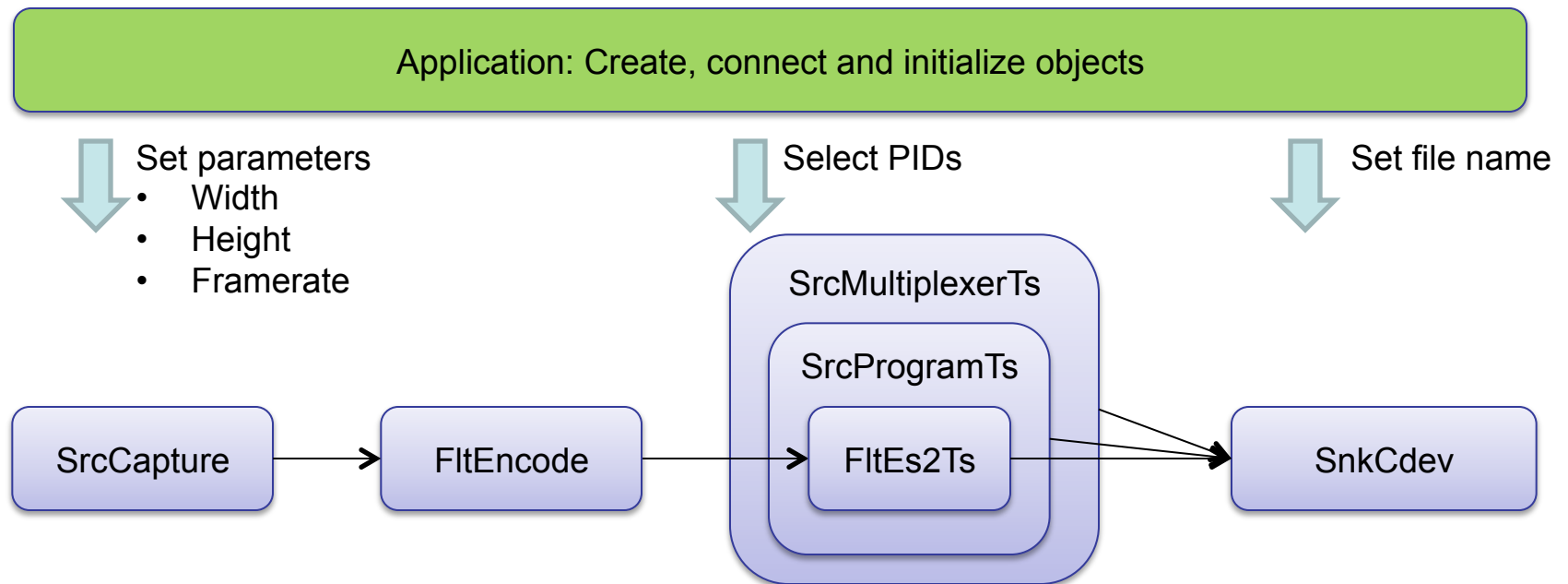 - Rear-seat-entertainment
  - Cruise recorder
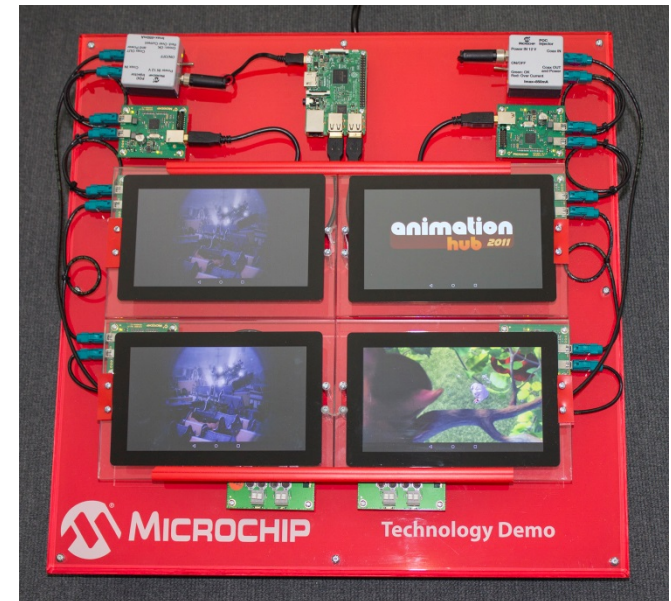
Example: Display

- **Receive a TS from a cdev**
- **Recover time (PCR)**
- **Peel off transport layer to get elementary stream**
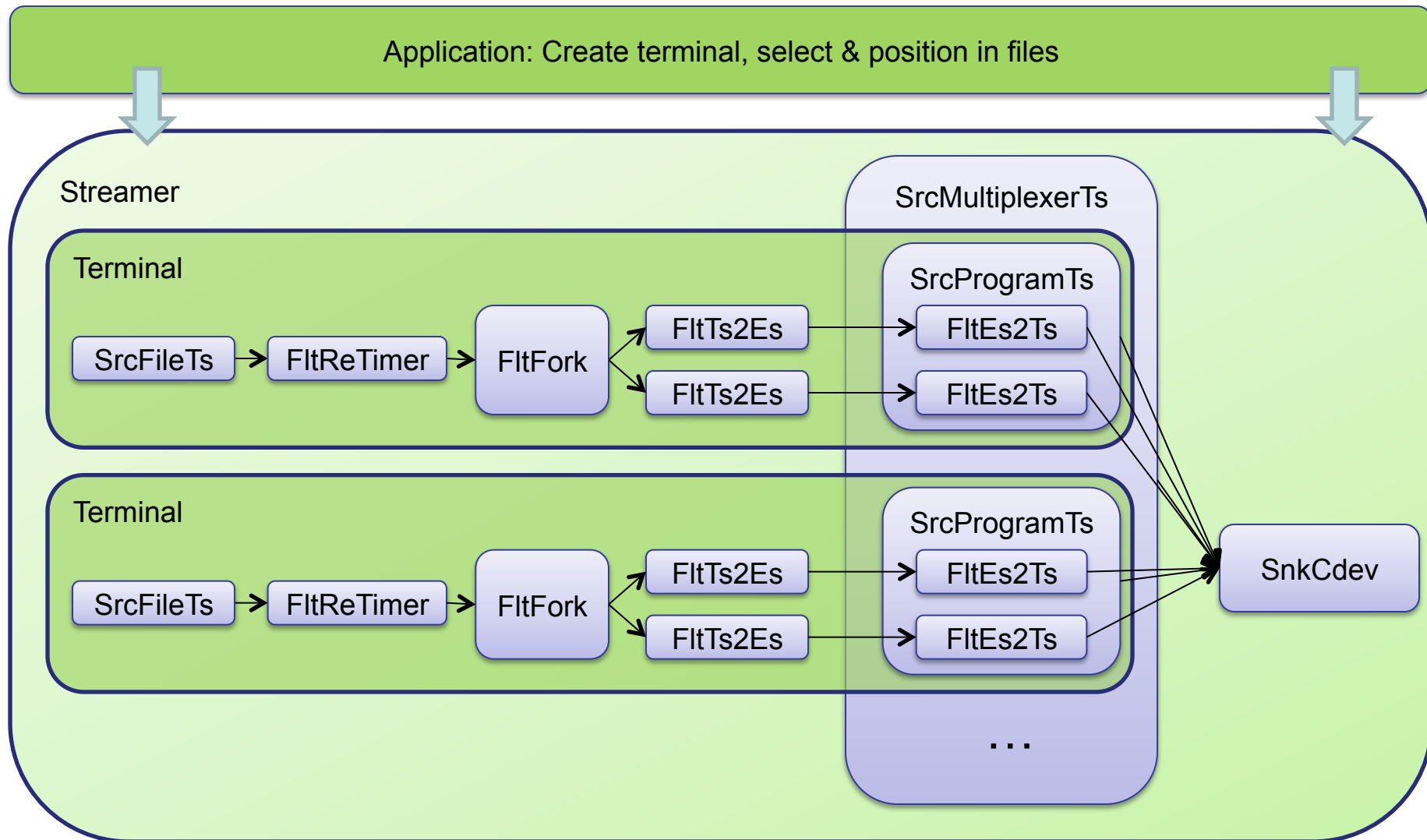- **Decode video**
- **Render according to PCR**
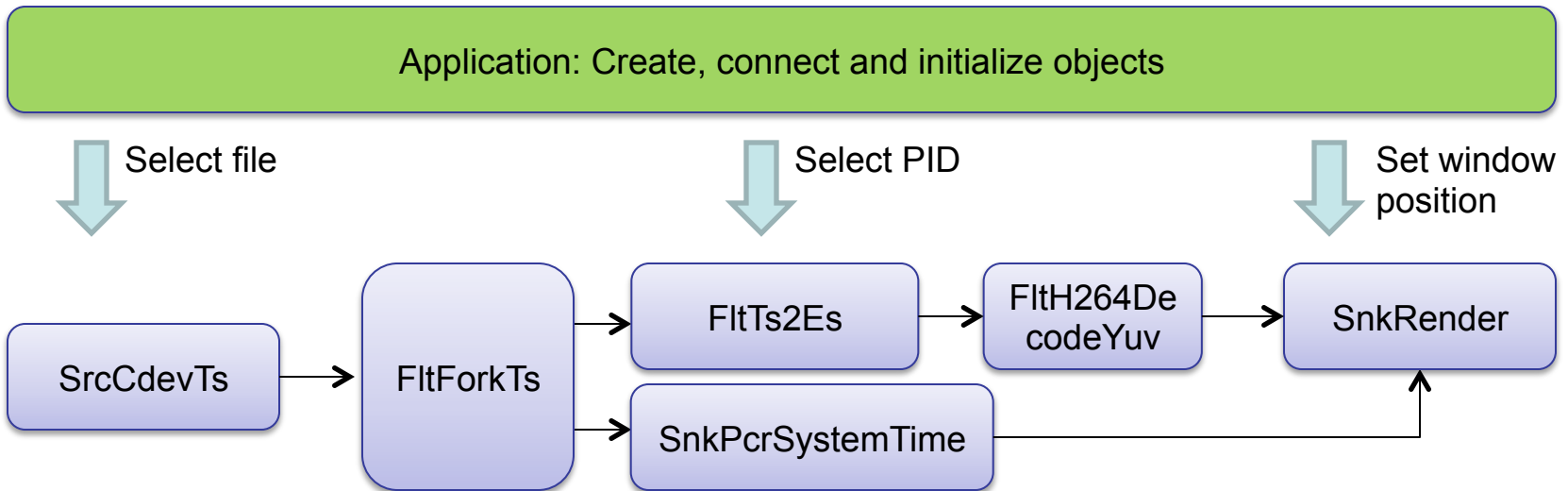
Example: Camera

- **Capture camera picture**
- **Encode to H.264**
- **Multiplex into a transport stream**
- **Send to network**

Example: Video-On-Demand

Application: Create terminal, select & position in files

Streamer

SrcMultiplexerTs

Terminal

SrcFileTs → FltReTimer → FltFork → FltTs2Es → SrcProgramTs FltEs2Ts
FltTs2Es → FltEs2Ts

Terminal

SrcFileTs → FltReTimer → FltFork → FltTs2Es → SrcProgramTs FltEs2Ts
FltTs2Es → FltEs2Ts

SnkCdev

. . .

Questions?

Thanks!